Claims

1. An electrical wire or cable having insulation comprising

(i) at least a first layer of a polyolefin-based material comprising at least 20%, by weight (of the whole material composition) of a carbonyl-containing polymer (homopolymer or copolymer or terpolymer), of which polymer the or at least one constituent monomer is a carboxylic acid ester, preferably an acrylate or acetate, especially an alkyl acrylate (e.g. methyl acrylate, ethyl acrylate, propyl acrylate or butyl acrylate), the said monomer itself constituting at least 5% by weight of the said co-, or ter- polymer when used and the remainder of the said co-, or ter- polymer preferably being derived from olefinic monomer, preferably ethylene;

in contact with

(ii) at least a second layer of a material containing at least 10%, by weight based on the whole material composition, of polyvinylidene fluoride (PVDF), or of a copolymer based on VDF with a partially or fully fluorinated co-monomer;

wherein the said layers (i) and (ii) whilst in contact with each other have been subjected to cross-linking reaction sufficient to increase the peel bond strength between the said layers to at least 5N.

2. An electrical wire or cable having insulation comprising

(i) at least a first layer of a polyolefin-based formulation, of which at least 20%, preferably at least 40%, more preferably at least 60% or very preferably at least 80% of the weight of the polymeric portion of the said formulation consists of a carbonyl-containing polymer (homopolymer or copolymer or terpolymer), of which polymer the or at least one constituent monomer is a carboxylic acid ester, preferably an acrylate or acetate, especially an alkyl acrylate (preferably methyl acrylate, ethyl acrylate, propyl acrylate or butyl acrylate), the said monomer itself constituting at least 5%, preferably at least 9%, more preferably at least 15% by weight of the said co-, or ter- polymer when used, and the remainder or the majority of the remainder of the said co-, or ter- polymer preferably being derived from olefinic monomer, preferably ethylene;

in contact with

(ii) at least a second layer of another material formulation, containing at least 10%, more preferably at least 50%, very preferably at least 90%, especially 100%, by weight of the second layer, of polyvinylidine fluoride (PVDF), or especially preferably a copolymer based on VDF with a partially or fully fluorinated co-monomer, most preferably a copolymer of VDF and hexafluoropropylene (HFP);

wherein the said layers (i) and (ii) whilst in contact with each other have been subjected to cross-linking reaction, preferably by radiation, more preferably ionising radiation, sufficient to prevent delamination of the two layers during a 1hour acetone immersion test at 23°C, or to increase the peel bond strength between the said layers to at least 5N according to the ASTM B1876-95 method described below preferably increasing the bond strength by at least 50%, more preferably by at least 100%, especially by at least 500% or 1000%, compared to that between the uncrosslinked layers.

3. A wire or cable according to claim 1, wherein the said layers (i) and (ii) whilst in contact with each other have been subjected to cross-linking reaction, preferably by radiation, more preferably ionising radiation, sufficient to prevent delamination of the two layers during a 1hour acetone immersion test at 23°C.

4. A wire or cable according to any preceding claim, wherein the cross-linking reaction has increased the bond strength by at least 50%, preferably by at least 100%, especially by at least 500% or 1000%, compared to that between the uncrosslinked layers.

5. A wire or cable according to any preceding claim, wherein the respective layers have been brought into contact with each other prior to cross-linking of either layer and at a temperature above the melting or softening point of the polymeric material in at least one of the layers.

6. A wire or cable according to any preceding claim, wherein the polyvinylidene fluoride-based layer comprises a copolymer of VDF and hexafluoropropylene (HFP), that copolymer constituting a majority by weight, preferably substantially all, of the material in that layer.

7. A wire or cable according to any preceding claim, wherein the polyvinylidene fluoride-based layer comprises a copolymer of VDF and hexafluoropropylene (HFP), preferably of HFP content 8-12wt%, very preferably 9-11wt%.

8. A wire or cable according to any preceding claim, wherein the polyolefin-based layer comprises a mixture of polyethylene and the said carbonyl-containing polymer.

9. A wire or cable according to any preceding claim, comprising an inner layer of the said polyolefin-based material and an outer layer of the said polyvinylidene fluoride-based material.

10. A wire or cable according to claim 9, wherein the said outer layer has been pressure-extruded onto the said inner layer.

11. A wire or cable according to any preceding claim, wherein the cross-linking reaction has been effected by radiation, preferably ionising radiation.

12. A wire or cable according to any preceding claim, comprising multiple alternating layers of the materials constituting the said layers (i) and (ii).

13. A wire or cable according to any preceding claim, which contains at least one crosslinking promoter in the material of either or both of the said layers (i) and (ii), the cross-linking promoter preferably having been added only to the material of the said layer (i).

14. A wire or cable according to any preceding claim, which contains at least one crosslinking promoter in the material of either or both of the said layers (i) and (ii), wherein the crosslinking promoter is a multifunctional acrylate or methacrylate ester, preferably trimethylolpropanetrimethacrylate (TMPTM).

15. A wire or cable according to claim 14, wherein the cross-linking promoter has been added only to the material of the said layer (i).

16. A wire or cable according to any of the preceding claims, wherein the polyvinylidene-based layer (ii) is substantially transparent, preferably containing substantially only PVDF or the said VDF co-polymer.

17. A method of making a wire or cable according to any of the preceding claims, comprising the steps of providing on an electrical conductor the said layers (i) and (ii) in contact with each other, and subjecting the said layers while in contact with each other to the said cross-linking reaction.

18. A method according to claim 17, wherein the respective layers are brought into contact with each other (a) prior to cross-linking of either layer and (b) at a temperature above the melting or softening point of the polymeric material in at least one of the layers.

19. A method according to claim 17 or 18, wherein layer (i) is pressure extruded onto the conductor and/or layer (ii) is pressure extruded over layer (i).

20. A method according to claim 17, 18, or 19, wherein layers (i) and (ii) are co-extruded or tandem extruded onto the wire in a single pass of the conductor from an extrusion process pay-out device to an extrusion process take-up device.

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